REMARKS

Applicant would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe the subject matter which applicant regards as the invention.

Claims 1, 3, 12, and 13 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair et al. (U.S. Patent No. 3,418,662) in view of McBean et al. (U.S. Patent No. 7,367,958). The rejections are traversed for the following reasons.

The Examiner's attention is directed to Amendments "D" and "E", which contain a description of the claims and cited art. Presently, applicant respectfully submits that the cited art fails to teach or suggest a control method for controlling an orthosis that changes an external force applied to an animal based on a comparison between a desired ratio of external force to total force and an actual ratio of external force to total force, where a new external force function is set if the difference between the desired ratio and the actual ratio is greater than a reference value.

To further clarify this claim feature, an amendment has been tendered to claim 1 so as to clarify that the internal force is a force caused by or inherent from the animal. Specifically, the internal force has been clarified as being a force at a first living body portion (the portion to which the orthosis is attached) of the animal that is caused by activities of the muscle fibers in at least a second living body portion of the animal. Further, the external force is clarified as being a force caused by motion of an actuator and applied to the first living body portion of the animal

through the orthosis.

Following this amendment, with particular reference to the claim steps, it is submitted that the cited art fails to teach or suggest a control method for controlling an orthosis attached to an animal that includes:

> "a motion variable measurement step of measuring a motion variable y varying with the motion of the animal under the condition of the external force applied through the orthosis … **wherein the motion variable measurement step comprises measuring the resultant force of an internal force <u>at the first living body portion caused by the activities animal muscle fibers in at least the second living body portion of the animal</u> and an external force <u>caused by a motion of an actuator and applied through the orthosis to the first living body portion</u> of the animal as the motion variable y**",

as is required by claim 1. Rather, Alastair does not teach an orthosis that is attached to an animal, and therefore cannot fairly suggest the measurement of a resultant force of an internal force and an external force of the animal. Further, while McBean does teach an orthosis attached to an animal, McBean does not suggest measuring a resultant force that is a sum of an internal force supplied by the animal and an external force that is supplied by the orthosis.

With specific reference to Alastair, the invention defined therein is directed to a control system for a prosthetic hand. The control system teaches that EMG signals are obtained from the flexor and extensor muscles via input electrodes (1, 2) provided to the forearm of the agent. The movement of the artificial hand is controlled based on the EMG signals. Alastair, Col. 2, lines 18 – 64, Figs. 1 and 2.

However, the prosthetic hand is not an orthosis that facilitates a part of an animal in moving. As such, the Alastair device does not experience any internal force at a (first) living body portion to which the orthosis is attached that is caused by activities of muscle fibers at a second living body portion. Rather, the activities of

the muscle fibers in Alastair (the flexor and extensor) cause no internal force to be applied to a body portion to which the orthosis is attached. In this vein, the muscle activity is measured without reference to an internal force caused thereby.

Thus, Alastair has no reason or capability to, and therefore does not, teach the measurement of an internal force (as defined by the claim) exerted by the animal at a body portion to which the prosthetic hand. To the extent that a force could be measured by the feedback device of Alastair, the force would be a resultant force caused exclusively by an external force acting on the prosthetic hand. Also, to the extent that there may be any force associated with the EMG signals from the flexor or extensor muscles of the animal, the force would in no way combine with the external force acting on the prosthetic hand, so as to fairly suggest the internal force of the claimed method.

Turning to the McBean reference, the invention defined therein is directed to a control method for an orthotic device. The orthotic device determines an intended muscular force via surface EMG sensors, force sensors, position sensors, velocity sensors, or some combination thereof. The force exerted by the externally worn brace can be selected such that it is proportional to a function of the magnitude of the sensor signals. McBean, Col. 4, lines 14 – 31.

However, McBean relies solely on the magnitude of the signals in setting the external force. There is no measurement of a resultant force including an internal force component, nor is there any consideration of the internal force in setting the external force based on the EMG sensors. Thus, to the extent that McBean sets a resultant force, this resultant force does not consider an internal force, and is therefore set to be equal to the external force. Accordingly, McBean is also silent as

to this feature of claim 1.

Thus, the combined references fail to teach or suggest a control method for an orthosis that includes a motion variable measuring step of "measuring the resultant force of an internal force at the first living body portion caused by activities of animal muscle fibers in at least the second living body portion of the animal and an external force caused by a motion of an actuator and applied through the orthosis to the first living body portion of the animal as the motion variable", as is required by claim 1. With reference to the Advisory action, the Examiner appears to agree with this position. Advisory action, page 2 (Alastair: "The force is not internal of the prosthetic"). For this reason alone, a *prima facie* case of obviousness in support of the rejection of claim 1 has not been established.

Further, though related to the above discussed feature of claim 1, the claimed control method also includes:

> **"a factor setting step of setting a value of a factor γ according to a factor function $\gamma(f, y)$ with the external force f and the motion variable y as variables on the basis of the set value of the external force f and the measured value of the motion variable y;**
>
> **a determination step of determining whether a deviation δ between the set value of the factor γ and target value γ_t thereof is less than a reference value ε; and**
>
> **an external force function setting step of setting a new external force function f(x) in such a way that the set value of the factor γ approaches the target value γ_t if the deviation δ is determined to be equal to or greater than the reference value ε in the determination step, wherein ...**
>
> **the factor setting step comprises setting the ratio of the external force f to the resultant force of the internal force and the external force of the animal as the factor γ ($0\leq \gamma<1$)",**

as required by claim 1. In summary, these claim steps recite that a factor between zero and one is set, where the factor is a ratio of the external force to the resultant force (external force plus internal force). Then, it is determined whether a

difference between the factor and a target factor is greater than a reference value. If so, then a new external force function is set that lowers the difference between the factor and the target factor.

It is submitted that the combined references fail to teach or suggest this additional feature of the claimed control method. Specifically, as discussed above, Alastair sets an external force function based solely on EMG signals and McBean does not consider an internal force component in setting an external force function. Accordingly, neither of the references teach or suggest adjusting an external force function based on a motion variable that includes both the external and internal forces, as the external and internal forces are defined by claim 1.

Insofar as a force feedback is described in Alastair, the force feedback is only related to the external force applied to the prosthetic hand. There is no adjustment of the movement of the prosthetic hand, e.g., the external force applied to the prosthetic hand, based on the independent movement of the prosthetic hand. As such, Alastair fails to teach or suggest an adjustment of an external force function based on a change in an internal force.

Further, to the extent that McBean considers the magnitude of sensors, the sensors do not monitor an internal force. However, even if the McBean sensors could be interpreted to monitor or measure an internal force, it is noted that the orthosis of McBean operates such that the greater the magnitude of the signal from the sensors, the greater the external force applied to the animal. McBean, Col. 4, lines 14 – 31. As such, the McBean device would operate in an opposite manner to the claimed control method. Particularly, as the sensor magnitudes of McBean increase, the external force increases. This is contrary to the control method of

claim 1, wherein a greater internal force results in a lessened external force. Also, to the extent a feedback is described in McBean, the feedback is only provided to ensure the required amount of external force is applied to the animal as determined by the magnitude of the EMG signals, and does not teach adjusting an external force function based on an internal force.

Thus, the combined references fail to teach or suggest adjusting an external force function based on a variable internal force exerted by the animal, as is required by claim 1. Accordingly, for this additional reason, the combined references fail to teach or suggest each and every feature of claim 1, and as such do not render claim 1 obvious. Consequently, reconsideration and withdrawal of the rejection of claim 1 is requested. Claims 3 and 12 depend from claim 1 and are therefore likewise considered allowable over the art.

With reference to claim 13, the invention defined therein is directed to an apparatus associated with the method defined in claim 1. As such, claim 13 has been amended in a manner similar to that of claim 1. Accordingly, the arguments presented above in favor of the patentability of claim 1 are considered relevant to claim 13. While the arguments will not be repeated, they are hereby incorporated in full.

As with claim 1, claim 13 recites features that are not taught or suggested by the combined references. Therefore, a *prima facie* case of obviousness has not been established to support the rejection of claim 13. Reconsideration and withdrawal of the rejection of claim 13 is requested.

Claims 2 and 5 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair and McBean as applied to claim 1, and in further view of Curcie et al.

(U.S. Patent No. 6,660,042). The rejections are traversed for the following reasons.

Claims 2 and 5 depend from claim 1. Therefore, to render claims 2 and 5 obvious, the combined references must teach or suggest all features of claim 1. In this regard, the shortcomings of the Alastair and McBean patents have been discussed above.

The Curcie patent is cited for teaching a method for distributing forelimb forces in which each finger is assigned a coefficient or weight related to the external force. Further Curcie is cited for teaching a method in which there is a training mode in which the function variables are determined in a training step and then the mode is switched to a use mode in which the equation for each finger remains constant.

However, Curcie fails to remedy the shortcomings of Alastair and McBean in regards to claim 1. Accordingly, claim 1 recites features that are not taught or suggested by the combination of Alastair, McBean, and Curcie. Therefore, claim 1 is not rendered obvious by the combined references. Consequently, claims 2 and 5, based on their dependence from claim 1, are considered allowable over the art. Reconsideration and withdrawal of the rejections of claims 2 and 5 is requested.

Claim 4 was rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair and McBean as applied to claims 1 and 3, and in further view of Haslam, II et al. (U.S. Patent No. 5,413,611). The rejection is traversed for the following reasons.

Claim 4 depends from claim 1. Therefore, to render claim 4 obvious, the combined references must teach or suggest all features of claim 1. In this regard, the shortcomings of the Alastair and McBean patents have been discussed above.

The Haslam patent is cited for teaching a force control method in which the

external force is controlled in such a way that the maximum measured force approaches the maximum target. However, Haslam fails to remedy the shortcomings of Alastair and McBean in regards to claim 1.

Accordingly, claim 1 recites features that are not taught or suggested by the combination of Alastair, McBean, and Haslam. Therefore, claim 1 is not rendered obvious by the combined references. Consequently, claim 4, based on its dependence from claim 1, is considered allowable over the art. Reconsideration and withdrawal of the rejections of claim 4 is requested.

Claims 7 and 8 were rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair and McBean as applied to claim 1, and in further view of Kawai et al. (US 2004/0107780). The rejections are traversed for the following reasons.

Claims 7 and 8 depend from claim 1. Therefore, to render claims 7 and 8 obvious, the combined references must teach or suggest all features of claim 1. In this regard, the shortcomings of the Alastair and McBean patents have been discussed above.

The Kawai application is cited for teaching an external force control method in which primitive variables are measured and inputted to an inverse dynamics model along with motion state data in order to determine the motion state. However, Kawai fails to remedy the shortcomings of Alastair and McBean in regards to claim 1.

Accordingly, claim 1 recites features that are not taught or suggested by the combination of Alastair, McBean, and Kawaii. Therefore, claim 1 is not rendered obvious by the combined references. Consequently, claims 7 and 8, based on their dependence from claim 1, are considered allowable over the art. Reconsideration and withdrawal of the rejections of claims 7 and 8 is requested.

Claims 9 – 11 and 14 were rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair and McBean as applied to claim 1, and in further view of Davalli et al. (U.S. Patent No. 6,740,123). The rejections are traversed for the following reasons.

Claims 9 - 11 depend from claim 1. Therefore, to render claims 9 – 11 obvious, the combined references must teach or suggest all features of claim 1. In this regard, the shortcomings of the Alastair and McBean patents have been discussed above.

The Davalli patent is cited for teaching four band factors each depending from the bend of the wrist and EMG activity feedback which results in different force controls. However, Davalli fails to remedy the shortcomings of Alastair and McBean in regards to claim 1.

Accordingly, claim 1 recites features that are not taught or suggested by the combination of Alastair, McBean, and Davalli. Therefore, claim 1 is not rendered obvious by the combined references. Consequently, claims 9 – 11, based on their dependence from claim 1, are considered allowable over the art. Reconsideration and withdrawal of the rejections of claims 9 – 11 is requested.

Claim 14 is directed to an external force control program for providing a computer with functions for controlling an external force applied to an animal through an orthosis attached to the animal that makes a movement along with the activities of muscle fibers. Essentially, claim 14 is directed to a control program that instructs a computer to perform method steps similar to those recited in claim 1. As such, claim 14 has been amended in a manner similar to that of claim 1.

As the inventive method of claim 14 is similar to that of claims 1 and 13, the

arguments presented above in favor of the patentability of claim 1 are considered relevant to the rejection of claim 14. Accordingly, while not repeated, the arguments are hereby incorporated in full. Therefore, as with claims 1 and 13, claim 14 recites features that are not taught or suggested by the Alastair and McBean patents. Further, as asserted above, Davalli does not remedy the shortcomings of Alastair and McBean in regards to claim 14.

Consequently, claim 14 is not rendered obvious by the combined references. Reconsideration and withdrawal of the rejection of claim 14 is requested.

In addition to claims 1 – 14, new claims 15 – 20 have been added for consideration in the present amendment. The new claims depend from the independent claims (1, 13, 14) and further define the first and second living body portions of the animal. As the cited art fails to teach the additional features recited in the new claims, the new claims are considered allowable over the art. Accordingly, favorable consideration of the new claims is requested.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. SAT-16887.

Respectfully submitted,

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